# Salsbury Cove Quadrangle, Maine


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* Geology of Mount Desert Island taken from Gilman and Chapman, 1988.



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## GEOLOGIC HISTORY

### ORIGIN OF THE ELLSWORTH SCHIST

The Ellsworth Schist (**€e**) originally formed as a thick accumulation of sedimentary and igneous rocks deposited in an ocean in Cambrian time (see Geologic Time Scale below). The volcanic materials included lava flows and deposits of rock fragments of various size. Most of the formation consists of thinly layered rocks which represent fine-grained sediments such as mud and silt that were eroded from a nearby volcanic region. Since they were deposited, all these rocks have been modified by heat and pressure at depth, a process called metamorphism, which somewhat obscures their original character. Though distorted, the thin layering of the rocks is widely preserved (**Photo 1**).

Thin sheets of igneous rock are common in the Ellsworth Schist. Igneous rocks originate from molten rock, or magma, that cools and solidifies. Most of the igneous rocks in the Ellsworth are of two types, a dark greenish gray rock called greenstone (**Photo 2**) and a white to cream-weathering rock called rhyolite (**Photo 3**). Most of the igneous rocks formed when lava erupted at the earth's surface, in some cases violently, during the time sediment was accumulating. A few igneous sheets probably solidified beneath the surface. The Lamoine Granite Gneiss (**S€lg**) may have intruded at this time. The Egypt Member of the Ellsworth (**€ee**) is a darker colored schist that contains greenstone but virtually no rhyolite. During metamorphism, distinctive white feldspar grains grew in the schist (**Photo 4**). The chemical composition of igneous rocks in the Ellsworth Schist suggests that they formed in a continental rift (Stewart, 1998).

**Photo 1.** Thinly interlayered white quartz-feldspar rock and grayish-green schist characteristic of the Ellsworth Schist (**€e**). Schist is a metamorphic rock that splits along flat surfaces. Folded layers are tilted up toward the northwest (left). (*Mosely Point.*)

**Photo 2.** Thin sheets of greenstone in schist. These are interpreted as volcanic layers that have been flattened during metamorphism. (*Ellsworth Schist. North of Mosely Point, Skillings River.*)

**Photo 3.** Two sheets of white volcanic rock (rhyolite) in the Ellsworth Schist (**€e**). Rhyolite is of the same chemical composition as granite, but has cooled rapidly from the molten state to form a hard, crystalline rock with very small mineral grains. (*Pecks Point, Skillings River.*)

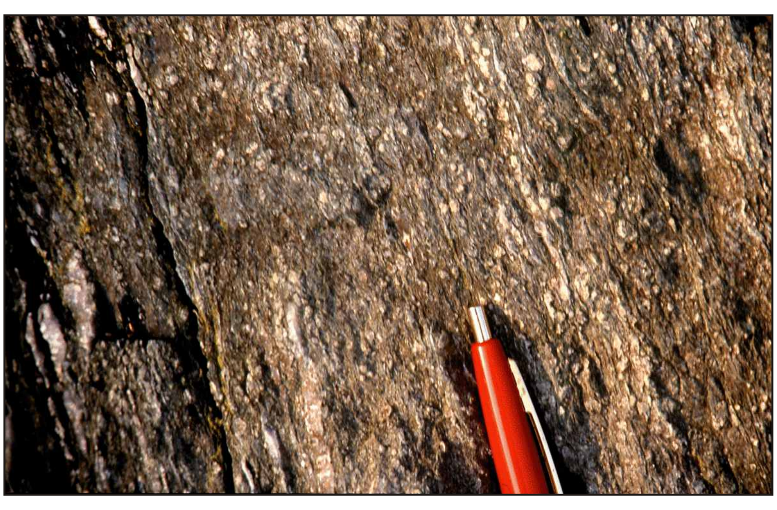

**Photo 4.** Dark colored, more uniform schist of the Egypt Member (**€ee**), with distinctive white feldspars. The feldspars grew in the rock during metamorphism. (*Skillings River, north edge of map.*)

### DEFORMATION AND METAMORPHISM OF THE ELLSWORTH SCHIST

The Ellsworth Schist has been deformed at least three times producing a highly contorted rock structure. In the main stage of deformation, wet sediments and the interlayered volcanic materials were squeezed from the sides and shoved toward the northwest. Distorted thin layers show that the rocks were crumpled into abundant small folds whose shapes reflect the northwest motion (**Photos 1, 5**). This deformation affected the entire mass of Ellsworth Schist. The most pervasive feature of every outcrop is the main foliation, a microscopic alignment of flat mineral grains giving the rock an overall sheet-like structure. On foliation surfaces, mineral grains have been stretched to form lines that constitute a mineral lineation (**Photo 6**). In most places the lineation is oriented in a northwest-southeast direction, as symbols on the map indicate.

The minerals that comprise the main foliation, chlorite and white mica, form at elevated temperatures, typically 350 to 400 degrees Centigrade. It is due to this heat that the rocks could be deformed by folding rather than by breaking. Also during heating, milky white quartz veins formed throughout the schist. These veins were deformed along with the rest of the rock. The age of deformation and metamorphism cannot be determined precisely in this map area; it must be younger than the Cambrian age of the Ellsworth Schist which is deformed, and older than the Silurian Bar Harbor Formation, which is not affected by the main stage of deformation.

The main foliation and lineation of the Ellsworth Schist were themselves distorted by a variety of later folds (**Photo 7**). Some appear to indicate movement towards the southeast, in a direction opposite to the earlier main stage movement. The Hancock-Trenton antiform, indicated on the map, is a broad warp in the regional bedrock structure that deforms the earlier, mainphase features.

Following the two stages of folding, brittle faults occurred. A few may be significant, shown by the heavy lines on the map, but most are minor features that are not very extensive (**Photo 8**). Some of the faults, particularly around the Cadillac Mountain Intrusive Complex, are related to intrusion of the large magma bodies. Other faults are probably of Mesozoic age.

**Photo 5.** Folded white quartz-feldspar layer displays effect of main phase deformation. View toward southwest. (*Raccoon Cove.*)

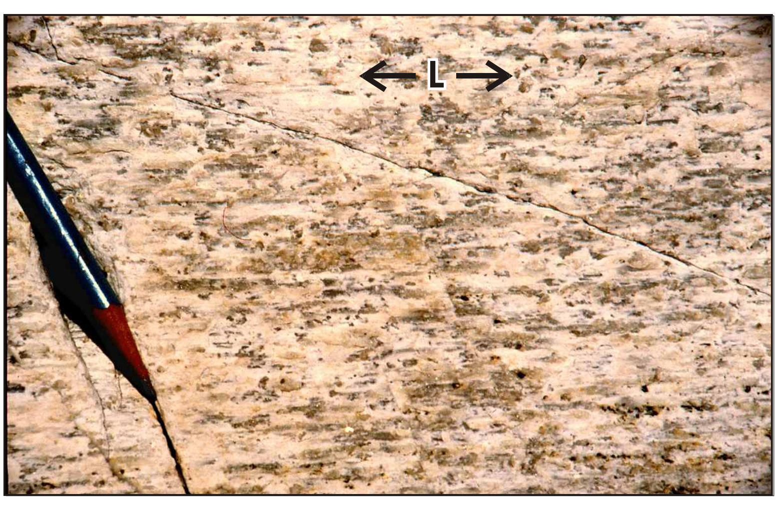


**Photo 6.** Streaks of quartz and feldspar on a rhyolite surface define a lineation (**L**) showing the rock was stretched. (*Lamoine State Park.*)

**Photo 7.** The main phase deformation fabric is overprinted by younger crenulation folds. Main phase fabric runs left to right along the bottom of the photo; crenulations run from upper right to lower left in center of photo. (*Shoreline west of Lamoine State Park.*)

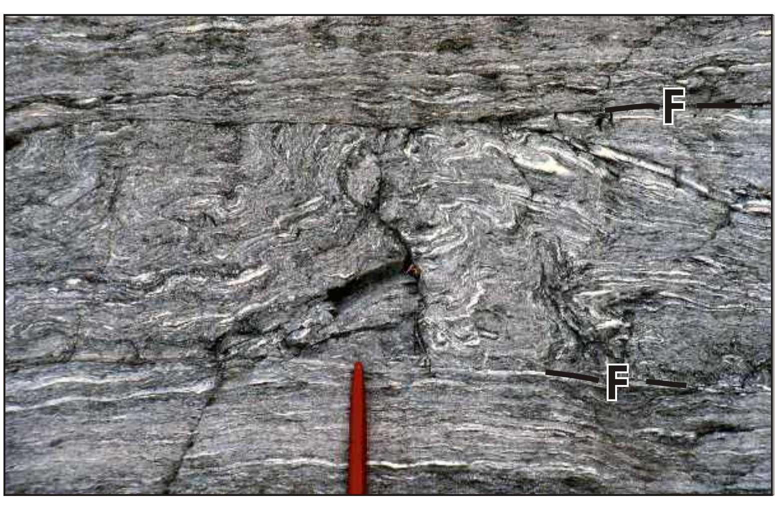


**Photo 8.** Two minor faults (**F**) cut the earlier metamorphic fabric. Rock layers are cut and have been displaced at the faults. This sort of small fault is common. (*Skillings River, north edge of map.*)

### DEPOSITION OF THE BAR HARBOR FORMATION

Some time after the main phase of deformation in the Ellsworth Schist, it was gradually uplifted to the surface and eroded. In Early Silurian time, layers of silt and limy sand began to accumulate on the exposed Ellsworth rocks, in a warm, shallow seaway. The broad, thin layers of accumulated sediment comprise the Bar Harbor Formation (**Photo 9**). Layers of volcanic ash indicate that there were volcanic islands in the vicinity, perhaps related to volcanic rocks now preserved on southern Mount Desert Island and the Cranberry Isles.

### INTRUSIVE ROCKS

Soon after deposition of the Bar Harbor sediments, melting of rocks at depth produced large volumes of magma that rose through the crust, intruded the Ellsworth Schist and Bar Harbor Formation, and slowly solidified. Three major batches of magma contributed to the igneous complex. A dense magma rich in iron formed gabbro (**Photo 10A**); a lighter magma formed the Cadillac Mountain Granite (**DScg**) (**Photo 10B**). The gabbro (**DSgd**), solidified before, during, and after intrusion of the granite. The third major intrusion, the Somesville Granite (**DSsg**), is a mixture of late stage magmas with new intrusions (Wiebe, 1994).

**Photo 9.** Prominent, nearly horizontal layers typify the Bar Harbor Formation (**Sbh**). (*North shore of Mount Desert Island, east of Sand Point*)

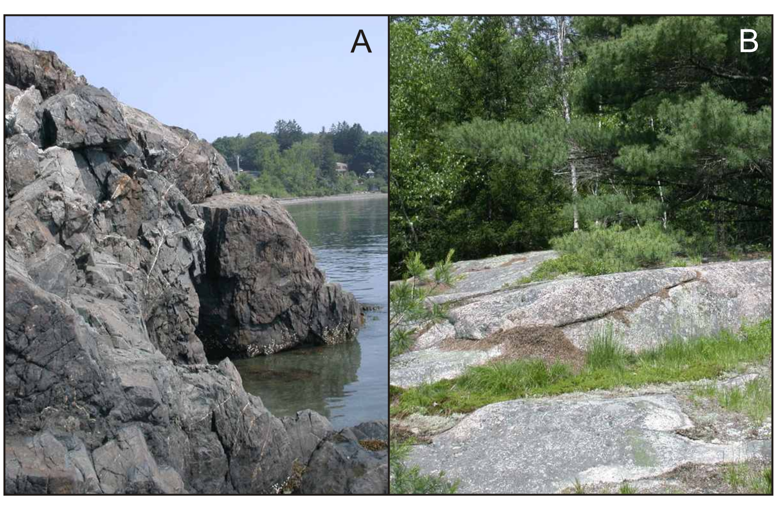


**Photo 10.** Rocks of the Cadillac Mountain Intrusive Complex. A. Dark gray diorite (**DSgd**) at Hulls Cove. B. Pink granite (**DScg**) beside the carriage trail south of Breakneck Ponds.

*Photos 1-8 and 11 by D. R. Reusch. Photos 9,10 by H. N. Berry.*

### PRESENT EXPOSURE

All the metamorphic and intrusive bedrock in the map area was once at depth in the earth. For these rocks to be exposed at the surface now, a significant amount of overlying rock must have been eroded in the hundreds of millions of years since the Devonian Period. The latest increment of erosion occurred during the last Ice Age, when a continental glacier extended across Maine and ground down some of the bedrock surface. The different types of bedrock have eroded differently, to produce the present varied landscape (**Photo 11**). The last glacier melted from the Maine coast about 14,000 years ago, leaving a blanket of sediment that covers most of the bedrock in the area.

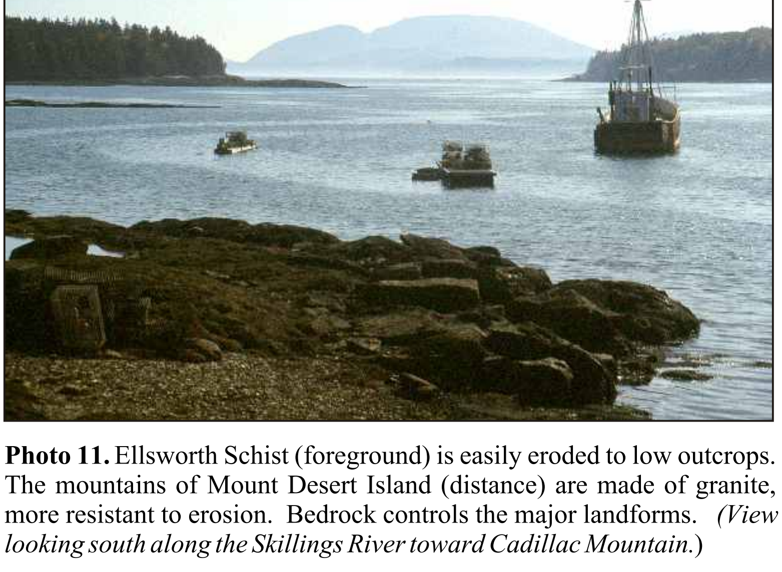

**Photo 11.** Ellsworth Schist (foreground) is easily eroded to low outcrops. The mountains of Mount Desert Island (distance) are made of granite, more resistant to erosion. Bedrock controls the major landforms. *(View looking south along the Skillings River toward Cadillac Mountain.)*

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